

1       What is claimed is:

2  
3       1. A printing device, comprising:

4       a plurality of print stations including dot-forming elements arranged to  
5       produce an image on a moving recording medium and provided in a redun-  
6       dant manner, thereby enabling dot-forming-element activity to be distributed  
7       between redundant dot-forming elements and errors of dot-forming elements  
8       to be compensated;

9       a lateral-position detector arrangement or predictor arranged to indicate  
10      the recording medium's lateral position relative to the print stations during a  
11      print process; and

12      a controller arranged to use at least one print mask for each print station  
13      arranged to distribute the dot-forming-element activity between the print sta-  
14      tions and to compensate the errors of dot-forming elements; wherein

15      the printing device is arranged so that, in response to a detected or pre-  
16      dicted change of the relative lateral position, at least one of the currently used  
17      print masks is replaced by another one relating to the changed relative lateral  
18      position.

19  
20      2. The printing device of claim 1, further comprising:

21      a conveyor arranged to move the recording medium during the print  
22      process.

23  
24      3. The printing device of claim 2, wherein the conveyor is a belt con-  
25      veyor.

26  
27      4. The printing device of claim 2, wherein the lateral-position detector ar-  
28      rangement is arranged to detect the conveyor's lateral position, which repre-  
29      sents an indication of the recording medium's lateral position.

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1        5. The printing device of claim 1, further comprising:  
2        a plurality of encoding marks which move with the moving recording me-  
3        dium and are indicative of the recording medium's lateral position;  
4        wherein the lateral-position detector arrangement comprises at least one  
5        sensor responsive to the encoding marks and arranged to detect the re-  
6        cording medium's lateral position.

7  
8        6. The printing device of claim 1, wherein  
9        at least some of the print masks are correlated, wherein the printing de-  
10       vice is arranged so that, in response to a detected or predicted change of the  
11       relative lateral position, the correlated print masks relating to the changed  
12       relative lateral position are replaced by others.

13  
14       7. The printing device of claim 1, wherein  
15       the lateral-position detector arrangement or predictor is arranged to at  
16       least indicate the lateral position of the recording medium from page to page  
17       during the print process; and  
18       the printing device is arranged so that, in response to a detected or pre-  
19       dicted change of the relative lateral position, the at least one of the currently  
20       used print masks is replaced from page to page by another one relating to the  
21       changed relative lateral position.

22  
23       8. The printing device of claim 1, wherein  
24       the lateral-position detector arrangement or predictor is arranged to indi-  
25       cate the lateral position of the recording medium within a page during the print  
26       process; and  
27       the printing device is arranged so that, in response to a detected or pre-  
28       dicted change of the relative lateral position, the at least one of the currently  
29       used print masks is replaced within the page by another one relating to the  
30       changed relative lateral position.

1       9. The printing device of claim 1, further comprising:  
2       a print-mask memory arranged to store print masks for different relative  
3 lateral recording medium's positions; wherein  
4       the controller is arranged, in response to a detected or predicted change  
5 of the relative lateral position, to use at least one other print mask from the  
6 stored print masks than the currently used one, this at least one other print  
7 mask relating to the changed relative lateral position.

8

9       10. The printing device of claim 1, further comprising:  
10       a dot-forming-element error detector;  
11       wherein the printing device is arranged, in response to newly detected  
12 dot-forming-element errors, to replace existing print masks by new print  
13 masks which also compensate the newly detected dot-forming-element er-  
14 rors.

15

16       11. The printing device of claim 1, wherein the print masks of redundant  
17 print stations associated with each other are complementary patterns mini-  
18 mizing or reducing blocks of contiguous dots or picture elements printed by  
19 each print station.

20

21       12. The printing device of claim 1, wherein the print masks of two re-  
22 dundant print stations associated with each other are complementary check-  
23 erboard-like patterns.

24

25       13. The printing device of claim 1, where the printing device is a multi-  
26 color printer.

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28       14. The printing device of claim 1, where the printing device is an ink-jet  
29 printer.

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31       15. The printing device of claim 1, where the printing device is a page-  
32 wide-array printer.

33

1       16. A printing device, comprising:

2       a plurality of print stations including dot-forming elements arranged to  
3       produce an image on a moving recording medium and provided in a redun-  
4       dant manner, thereby enabling dot-forming-element activity to be distributed  
5       between redundant dot-forming elements and errors of dot-forming elements  
6       to be compensated;

7       a lateral-position detector arrangement or predictor arranged to indicate  
8       the recording medium's lateral position relative to the print stations during a  
9       print process; and

10      a controller arranged to use at least one print mask for each print station  
11      arranged to distribute the dot-forming-element activity between the print sta-  
12      tions and to compensate the errors of dot-forming elements; and

13      a print-mask memory arranged to store print masks for different relative  
14      lateral recording medium's positions; wherein

15      the controller is arranged, in response to a detected or predicted change  
16      of the relative lateral position, to use at least one other print mask from the  
17      stored print masks than the currently used one, this at least one other print  
18      mask relating to the changed relative lateral position.

19

20      17. The printing device of claim 16, wherein

21      at least some of the print masks are correlated,

22      wherein the controller is arranged, in response to a detected or pre-  
23      dicted change of the relative lateral position, to use other correlated print  
24      masks from the stored print masks than the currently used ones, these other  
25      ones relating to the changed relative lateral position.

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1       18. The printing device of claim 16, wherein  
2       the lateral-position detector arrangement or predictor is arranged to at  
3       least indicate the lateral position of the recording medium from page to page  
4       during the print process; and  
5       the controller is arranged, in response to a detected or predicted change  
6       of the relative lateral position, to use, from page to page, at least one other  
7       print mask from the stored print masks than the currently used one, this at  
8       least one other print mask relating to the changed relative lateral position.

9  
10       19. The printing device of claim 16, wherein  
11       the lateral-position detector arrangement or predictor is arranged to indi-  
12       cate the lateral position of the recording medium within a page during the print  
13       process; and  
14       the controller is arranged, in response to a detected or predicted change  
15       of the relative lateral position, to use, within the page, at least one other print  
16       mask from the stored print masks than the currently used one, this at least  
17       one other print mask relating to the changed relative lateral position.

18  
19       20. The printing device of claim 16, further comprising:  
20       a dot-forming-element error detector;  
21       wherein the printing device is arranged, in response to newly detected  
22       dot-forming-element errors, to replace existing stored print masks for the dif-  
23       ferent relative lateral recording medium's positions by new print masks for the  
24       different relative lateral recording medium's positions which also compensate  
25       the newly detected dot-forming-element errors, and store the new print mask  
26       in the print-mask memory.

1       21. A printing device, comprising:  
2       at least one print station including dot-forming elements arranged to  
3       produce an image on a moving recording medium;  
4       a drum arranged to convey the recording medium past the at least one  
5       print station, wherein, by performing more than one turn, the drum is enabled  
6       to convey the recording medium more than once past the at least one print  
7       station, thereby creating an effective dot-forming-element redundancy;  
8       a lateral-shift mechanism arranged to perform a relative lateral shift be-  
9       tween the print station and the recording medium from one drum turn to an-  
10      other drum turn, thereby enabling dot-forming-element activity to be distrib-  
11      uted between drum turns and errors of dot-forming elements to be compen-  
12      sated;  
13      a lateral-position detector arrangement or predictor arranged to indicate  
14      the relative lateral shift between the recording medium and the print station;  
15      and  
16      a controller arranged to use at least one print mask for the at least one  
17      print station for each drum turn and each detected or predicted relative lateral  
18      position between the print station and the recording medium, wherein the print  
19      masks are arranged to distribute the dot-forming-element activity between the  
20      drum turns and, in addition, to compensate the errors of dot-forming ele-  
21      ments.

22

23       22. The printing device of claim 21, wherein the lateral-position detector  
24      arrangement is arranged to detect the drum's lateral position, which repre-  
25      sents an indication of the recording medium's lateral position.

26

27       23. The printing device of claim 21, wherein the lateral-position detector  
28      arrangement is arranged to directly detect the recording medium's lateral po-  
29      sition.

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31       24. The printing device of claim 21, wherein the lateral-position detector  
32      arrangement is arranged to detect the print station's lateral position.

33

1       25. The printing device of claim 21, wherein  
2       at least some of the print masks are correlated, wherein the printing de-  
3 vice is arranged so that, in response to a detected or predicted change of the  
4 relative lateral position, the correlated print masks relating to the changed  
5 relative lateral position are replaced by others.

6  
7       26. The printing device of claim 21, wherein  
8       the lateral-position detector arrangement or predictor is arranged to at  
9 least indicate the relative lateral position of the recording medium from drum  
10 turn to drum turn during the print process.

11  
12       27. The printing device of claim 21, wherein  
13       the lateral-position detector arrangement or predictor is arranged to indi-  
14 cate the relative lateral position of the recording medium within a drum turn  
15 during the print process; and

16       the printing device is arranged so that, in response to a detected or pre-  
17 dicted change of the relative lateral position, the at least one of the currently  
18 used print masks is replaced within the drum turn by another one relating to  
19 the changed relative lateral position.

20  
21       28. The printing device of claim 21, further comprising:  
22       a print-mask memory arranged to store print masks for different relative  
23 lateral recording medium's positions; wherein

24       the controller is arranged, in response to a detected or predicted change  
25 of the relative lateral position, to use at least one other print mask from the  
26 stored print masks than the currently used one, this at least one other print  
27 mask relating to the changed relative lateral position.

28

1        29. The printing device of claim 21, further comprising:

2        a dot-forming-element error detector;

3        wherein the printing device is arranged, in response to newly detected  
4 dot-forming-element errors, to replace existing print masks by new print  
5 masks which also compensate the newly detected dot-forming-element er-  
6 rors.

7

8        30. The printing device of claim 21, wherein the print masks of redun-  
9 dant drum turns associated with each other are complementary patterns  
10 minimizing or reducing blocks of contiguous dots or picture elements printed  
11 during the respective drum turn.

12

13        31. The printing device of claim 21, wherein the print masks of two re-  
14 dundant drum turns associated with each other are complementary checker-  
15 board-like patterns.

16

17        32. The printing device of claim 21, where the printing device is a multi-  
18 color printer.

19

20        33. The printing device of claim 21, where the printing device is an ink-  
21 jet printer.

22

23        34. The printing device of claim 21, where the printing device is a page-  
24 wide-array printer.

25



1       35. A printing device, comprising:

2       at least one print station including dot-forming elements arranged to  
3       produce an image on a moving recording medium;

4       a drum arranged to convey the recording medium past the at least one  
5       print station, wherein, by performing more than one turn, the drum is enabled  
6       to convey the recording medium more than once past the at least one print  
7       station, thereby creating an effective dot-forming-element redundancy;

8       a lateral-shift mechanism arranged to perform a relative lateral shift be-  
9       tween the print station and the recording medium from one drum turn to an-  
10      other drum turn, thereby enabling dot-forming-element activity to be distrib-  
11      uted between drum turns and errors of dot-forming elements to be compen-  
12      sated;

13      a lateral-position detector arrangement or predictor arranged to indicate  
14      the recording medium's lateral position relative to the print station;

15      a print-mask memory arranged to store print masks for each drum turn  
16      and each detected or predicted relative lateral position between the print sta-  
17      tion and the recording medium, wherein the print masks are arranged to dis-  
18      tribute the dot-forming-element activity between the drum turns and in addi-  
19      tion to compensate the errors of dot-forming elements; and

20      a controller arranged to use at least one print mask from the stored print  
21      masks for the at least one print station during the printing operation.

22

23      36. The printing device of claim 35, wherein

24      at least some of the print masks are correlated,

25      wherein the controller is arranged, in response to a detected or pre-  
26      dicted change of the relative lateral position, to use other correlated print  
27      masks from the stored print masks than the currently used ones, these other  
28      ones relating to the changed relative lateral position.

29

1        37. The printing device of claim 35, wherein  
2        the lateral-position detector arrangement or predictor is arranged to at  
3        least indicate the lateral position of the recording medium from drum turn to  
4        drum turn during the print process; and  
5        the controller is arranged, in response to a detected or predicted change  
6        of the relative lateral position, to use, from drum turn to drum turn, at least  
7        one other print mask from the stored print masks than the currently used one,  
8        this at least one other print mask relating to the changed relative lateral posi-  
9        tion.

10

11       38. The printing device of claim 35, wherein  
12       the lateral-position detector arrangement or predictor is arranged to indi-  
13       cate the lateral position of the recording medium within a drum turn during the  
14       print process; and  
15       the controller is arranged, in response to a detected or predicted change  
16       of the relative lateral position, to use, within the drum turn, at least one other  
17       print mask from the stored print masks than the currently used one, this at  
18       least one other print mask relating to the changed relative lateral position.

19

20       39. The printing device of claim 35, further comprising:  
21       a dot-forming-element error detector;  
22       wherein the printing device is arranged, in response to newly detected  
23       dot-forming-element errors, to replace existing stored print masks for the dif-  
24       ferent relative lateral recording medium's positions by new print masks for the  
25       different relative lateral recording medium's positions which also compensate  
26       the newly detected dot-forming-element errors, and store the new print mask  
27       in the print-mask memory.

28

1       40. A method of compensating lateral position changes of a moving re-  
2       cording medium during a print process, in which at least one image is printed  
3       by a plurality of print stations including dot-forming elements, based on image  
4       data, wherein redundant dot-forming elements are provided, thereby enabling  
5       dot-forming-element activity to be distributed between redundant dot-forming  
6       elements, and errors of dot-forming elements to be compensated, by using  
7       print masks; comprising:

8       detecting or predicting the lateral position of the recording medium rela-  
9       tive to the print stations during a print process;

10       using the image data and at least one print mask for each print station to  
11       distribute the dot-forming-element activity between the print stations and to  
12       compensate the errors of dot-forming elements; and

13       replacing, in response to a detected or predicted change of the relative  
14       lateral position, at least one of the currently used print masks by another one  
15       relating to the changed relative lateral position.

16  
17       41. The method of Claim 40, the step of replacing at least one of the  
18       currently used print masks, further comprises the step of, in response to the  
19       detected or predicted change of the lateral position between a first and a sec-  
20       ond print stations of said plurality of print stations, shifting the image data to  
21       be printed by said second print station.

22

1       42. A method of compensating lateral position changes of a moving re-  
2       cording medium during a print process, in which at least one image is printed  
3       by a plurality of print stations including dot-forming elements, based on image  
4       data, wherein redundant dot-forming elements are provided, thereby enabling  
5       dot-forming-element activity to be distributed between redundant dot-forming  
6       elements, and errors of dot-forming elements to be compensated, by using  
7       print masks, wherein a set of such print masks for different relative lateral po-  
8       sitions of the recording medium is pre-calculated and stored; comprising:

9       detecting or predicting the lateral position of the recording medium rela-  
10      tive to the print stations during a print process;

11      using the image data and at least one print mask for each print station to  
12      distribute the dot-forming-element activity between the print stations and to  
13      compensate the errors of dot-forming elements; and

14      using, in response to a detected or predicted change of the relative lat-  
15      eral position, at least one other print mask from the stored print masks than  
16      the currently used one, this at least one other print mask relating to the  
17      changed relative lateral position.

18  
19      43. The method of Claim 42, the step of using at least one other print  
20      masks, further comprises the step of, in response to the changed relative lat-  
21      eral position between a first and a second print stations of said plurality of  
22      print stations, shifting the image data to be printed by said second print sta-  
23      tion.

24

1        44. A method of compensating lateral relative position changes of a  
2 moving recording medium during a print process, in which at least one image  
3 is printed, based on image data, by at least one print station of a drum system  
4 during more than one drum turn, wherein effective dot-forming-element re-  
5 dundancy is created by executing additional drum turns and laterally shifting  
6 the print station between drum turns, thereby enabling dot-forming-element  
7 activity to be distributed between the drum turns and errors of dot-forming  
8 elements to be compensated, by using print masks; comprising:

9        detecting or predicting the lateral position of the recording medium rela-  
10 tive to the at least one print station during a print process;

11        using the image data and at least one print mask for each print station  
12 for each drum turn and detected or predicted relative lateral position between  
13 the print station and the recording medium, wherein the print masks distribute  
14 dot-forming-element activity between the drum turns and, in addition, com-  
15 pensate the errors of dot-forming elements.

16  
17        45. The method of Claim 44, the using step further comprises the step  
18 of, in response to the detected or predicted change of the lateral position be-  
19 tween a first and a second drum turn of said more than one turns, shifting the  
20 image data to be printed by said print station during said second turn.

21

1       46. A method of compensating lateral relative position changes of a  
2 moving recording medium during a print process, in which at least one image  
3 is printed, based on image data, by at least one print station of a drum system  
4 during more than one drum turn, wherein effective dot-forming-element re-  
5 dundancy is created by executing additional drum turns and laterally shifting  
6 the print station between drum turns, thereby enabling dot-forming-element  
7 activity to be distributed between the drum turns and errors of dot-forming  
8 elements to be compensated, by using print masks, wherein a set of such  
9 print masks for different relative lateral positions of the recording medium is  
10 pre-calculated and stored; comprising:

11       detecting or predicting the lateral position of the recording medium rela-  
12 tive to the at least one print station during a print process;

13       using the image data and at least one print mask from the stored print  
14 masks for each print station for each drum turn and detected or predicted  
15 relative lateral position between the print station and the recording medium,  
16 wherein the print masks distribute dot-forming-element activity between the  
17 drum turns and, in addition, compensate the errors of dot-forming elements.

18  
19       47. The method of Claim 46, the using step further comprises the step  
20 of, in response to the detected or predicted relative lateral position between a  
21 first and a second drum turn of said more than one turns, shifting the image  
22 data to be printed by said print station during said second turn